Westinghouse
Hanford Company

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P.O. Box 1970 Richland, WA 99352

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May 17, 1989

Mr. R. E. Gerton, Director
Waste Management Division
U.S. Department of Energy
Richland Operations Office
Richland, Washington 99352

Dear Mr. Gerton:

SINGLE-SHELL TANK LEAK VOLUMES

Reference: Letter, G. J. Bracken, DOE-RL, to President, WHC, same subject, WMD:JEN, dated April 27, 1989.

In the reference, Westinghouse Hanford Company (WHC) was requested to review the estimated leak volumes for single-shell tanks. This review was to include tanks for which leak volumes were not previously estimated due to the inconclusive data available on these tanks. Prior to 1984, the tanks with inconclusive data were classified as Questionable Integrity. This classification was used when there was difficulty in determining whether or not a tank had leaked. The Questionable Integrity tanks were later classified as Assumed Leakers. This was a very conservative action. This letter with attachment is the WHC response to that request.

The reference also contained a request to develop a plan for disseminating changes (if appropriate) to previously published leak volume estimates. Westinghouse Hanford Company intends to place the list of estimated leak volumes into document WHC-EP-0182, "Tank Farm Surveillance and Waste Status Summary Report" (which is a monthly public release document subject to Department of Energy-Richland Operations Office approval), during future updates. This action will allow for updating the list of tanks and estimated leak volumes if a more accurate means of estimating leak volumes does become available, or any further tanks are classified as Assumed Leakers.

If further information is required, please contact Mr. R. E. Raymond on 373-2785.

Very truly yours,

R E Raymond

for R. J. Baumhardt, Manager
Tank Farms
Defense Waste Management Division

bjb

Attachment

DOE-RL - A. W. Kellogg (w/o attachment)

SINGLE-SHELL TANK LEAK VOLUME ESTIMATE SUMMARY

REFERENCES

1. RHO-CD-213, B. N. Anderson and C. M. Walker, "Waste Storage Tank Status and Leak Detection Criteria".

2. SD-WM-SAR-006, Rev. 1, D. A. Smith, "Single-Shell Tank Isolation Safety Analysis Report", January, 1986.

3. Document, ERDA-1538, "Final Environmental Statement, Vol. 2", December, 1975.

4. Document, R. J. Catlin, "Assessment of the Surveillance Program of the High-Level Waste Storage Tanks at Hanford", March, 1980.

5. PNL-4688, K. S. Murthy et al., "Assessment of Single-Shell Tank Residual Liquid Issues at Hanford Site, Washington", June, 1983.

6. RHO-RE-SR-14, D. C. McCann and T. S. Vail, "Waste Status Summary", September, 1984.

7. RHO-ST-34, R. E. Isaacson and K. A. Gasper, "A Scientific Basis for Establishing Dry Well Monitoring Frequencies", December, 1981.

INTRODUCTION

This attachment includes a discussion of the methodology used to estimate the total leak volume from the single-shell tanks. A total of 66 tanks are assumed to have leaked. Sixty of the 66 tanks were suspected of leaking prior to 1984. Twenty-nine of the 60 tanks were classified as Confirmed Leaker tanks. These are tanks for which surveillance data provides conclusive evidence of leakage. The remaining 31 tanks were classified as Questionable Integrity tanks. These are tanks where surveillance data does not provide conclusive evidence of leakage. In 1984, classifications were changed and the Confirmed Leaker and Questionable Integrity classifications were combined into a classification designated as Assumed Leaker.

Westinghouse Hanford Company (WHC) was requested by the Department of Energy, Richland Operations Office (DOE-RL) to determine leak volume estimates for the Questionable Integrity tanks. Due to the change in the manner we report and categorize tank leaks, the total estimated leak volume has increased. Past published documentation has indicated a total estimated leak volume of approximately 500,000 gallons. However, this number was based on estimated leak volumes from tanks with the previous (prior to 1984) integrity classification of Confirmed Leaker. The revised total estimated leak volume (Tables 1 and 2) includes previously estimated leak volumes, estimated leak volumes from the Questionable Integrity tanks, and the 6 tanks that were recently categorized as Assumed Leaker (post-1984).

BACKGROUND

The first single-shell tanks were constructed in 1943-1944 to store radioactive liquid waste material generated as a result of plutonium production and separation operations at Hanford. In 1961, the first single-shell tank was confirmed to have leaked. Thus far, 66 tanks are classified as Assumed Leakers. Single-shell tanks are underground, reinforced concrete tanks with carbon steel liners having capacities ranging from 55,000 gallons to 1,000,000 gallons. A total of 149 single-shell tanks have been in active service. The last single-shell tanks were placed into service in 1964. Single-shell tanks were taken out of service in 1980; i.e., these tanks ceased to receive any newly generated waste.

A Waste Concentration and Solidification Program was implemented to reduce the waste volume stored in the single-shell tanks. Implementation of this program left concentrated waste containing residual liquids (supernatant and free standing liquids), interstitial liquids (liquids within saturated solids), and solids. Further liquid removal occurred through the Interim Stabilization Program; i.e., the residual liquids were transferred from single-shell tanks to double-shell tanks (DSTs). To date, 98 of the 149 single-shell tanks have been interim stabilized.

To minimize the risks of additional leakage from the single-shell tanks, double-shell tanks were built to store liquid waste removed from the single-shell tanks. The double-shell tanks also provide storage for newly generated waste. The double-shell tanks were designed for double containment so that leaks could be detected before the waste reached the soil. In 1972, Hanford began the transfer of liquid waste from the single-shell tanks to the double-shell tanks. A total of 28 double-shell tanks are currently in operation.

SUMMARY

Six documents (references 1, 2, 3, 4, 5 and 6) were reviewed to find leak volumes that had been previously reported (39 tanks). The methods used to estimate these leak volumes were not reviewed, except to identify which were based on liquid level data. Where differences were noted between the reference documents, the more conservative (larger) volume was used unless existing liquid level data could be used to confirm one of the volumes. The total volume of leakage from the 39 tanks is estimated to be 540,000 gallons. There were 27 tanks for which leak volumes have not previously been reported. Of these 27 tanks, the leak volumes for 6 tanks could be determined using liquid level data, and 2 additional tank leaks were estimated as 2,000 gallons each. This estimate was made because radiation was detected at an associated drywell, but there was no detectable surface level decrease. A liquid surface was being measured at the time radiation was detected at the drywell. It is unreasonable to assume that more than 2,000 gallons leaked without a surface level decrease.

Tank histories and reference 1 were then reviewed to determine how the leak was discovered: drywell, lateral data or liquid level decrease. Liquid level decrease is the most accurate method of leak volume determination. There were 24 tanks where the leak volumes were determined by liquid level.

Two of the tanks, 241-SX-110 and 241-T-106, were not included in the basis used to make the estimate. These two tanks were excluded based on a precedent set in reference 7 (these tank leaks were considered to be atypical). This yields a base of 22 accurately developed tank leak volumes. Four tanks (241-B-201, -203, -204 and 241-C-203) of the 22 tanks have an internal diameter of 20 feet, which is considerably smaller than the 75-foot diameter tanks. These 4 tanks were also excluded from the basis used to make the estimate. This left 18 tanks to use as the basis for estimating the leak volumes from the remaining 19 tanks.

Methods were then used (using the 18 tanks for which liquid level data could be used) to estimate the leak volumes for the remaining 19 tanks. This resulted in a leak volume estimate of 150,000 gallons for these 19 tanks. The estimate of total leak volume for all 66 tanks is 750,000 gallons. This is summarized in Table 1.

Table 1. ESTIMATE OF TOTAL LEAK VOLUME (66 TANKS)

		TOTAL GALLONS
Previously Published Volumes (39 tanks)	542,000	
Estimated by Liquid Level not previously published (6 tanks)	47,000	
Drywell Detected, Liquid Surface and No Detectable Decrease (2 tanks)	4,000	
SUBTOTAL	593,000	593,000
Leak Volume Estimate (19 tanks)		150,000
ESTIMATE OF TOTAL LEAK VOLUME (66 tanks)		750,000

CONCLUSIONS

The total has been rounded to the nearest 50,000 gallons (750,000 gallons). Upper bound values were used in many cases in developing this estimate. Rounding has generally been up to the next higher figure, and it is likely that some of these tanks have not actually leaked.

A list of estimated leak volumes for 39 tanks that were previously reported is provided in Table 2A; Table 2B lists the newly estimated leak volumes in the remaining 27 tanks.

Table 2A. LEAK VOLUMES PREVIOUSLY ESTIMATED AND REPORTED (39 TANKS)***

TANK	VOLUME (gallons)	TANK	VOLUME (gallons)
241-A-103*	5,500	241-SX-109*	5,000
241-A-104	2,500	241-SX-110*	5,500
241-A-105**	5,000	241-SX-111	2,000
241-AX-102*	3,000	241-SX-112	30,000
241-B-107*	8,000	241-SX-113	15,000
241-B-110*	10,000	241-SX-115	50,000
241-B-201*	1,200	241-T-106*	115,000
241-B-203*	300	241-T-108*	<1,000
241-BX-102	70,000	241-T-111*	<1,000
241-BX-108	2,500	241-TX-107	2,500
241-BY-103	<5,000	241-TY-101*	<1,000
241-BY-108	<5,000	241-TY-103	3,000
241-C-101*	20,000	241-TY-104*	1,400
241-C-201	550	241-TY-105	35,000
241-C-202	450	241-TY-106	20,000
241-C-203*	400	241-U-101	30,000
241-C-204	350	241-U-104	55,000
241-SX-104*	6,000	241-U-110*	8,100
241-SX-107	<5,000	241-U-112*	8,500
241-SX-108	2,400		

* Based on liquid level calculations.

** Cooling water was added to 241-A-105 after the tank was declared a leaker to aid evaporative cooling. It is believed some of this liquid did go to ground. The past practice was to not include the cooling water in the leak volume estimate. The scope of this letter did not include a review of the methods used previously to estimate leak volumes.

*** Total 39 tanks = 542,000 gallons.

Table 2B. LEAK VOLUMES NOT PREVIOUSLY ESTIMATED (27 TANKS)

TANK	VOLUME (gallons)
241-B-204	400
241-BY-107	15,100
241-C-111	5,500
241-S-104	24,000
241-T-103	<1,000
241-T-109	<1,000
SUBTOTAL (6 TANKS)	47,000*
241-B-112	2,000
241-C-110	2,000
SUBTOTAL (2 TANKS)	4,000**
241-AX-104	
241-B-101	
241-B-103	
241-B-105	
241-B-111	
241-BX-101	
241-BX-110	
241-BX-111	
241-BY-105	
241-BY-106	
241-SX-114	
241-T-107	
241-TX-105	
241-TX-110	
241-TX-113	
241-TX-114	
241-TX-115	
241-TX-116	
241-TX-117	
SUBTOTAL (19 TANKS)	150,000***

* Based on liquid level calculations.
** Leak was suspected due to detection of radiation in a drywell. Surface level data considered reliable (i.e., liquid surface) and there was no detectable decrease.
*** Estimate rounded to the nearest 10,000 gallons.

DISTRIBUTION COVERSHEET

Author	Addressee	Correspondence No.
R. J. Baumhardt	Mr. R. E. Gerton U.S. Department of Energy Richland Operations Office Richland, Washington 99352	8901832B R1

Subject

SINGLE-SHELL TANK LEAK VOLUMES

Internal Distribution

Approval		Date	Name	Location	w/att
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X	[signature]	5/16/89	T. L. Bennington	S1-52	X
			V. C. Boyles	R1-51	X
			H. F. Daugherty	R2-53	X
			A. J. Diliberto	R2-11	X
			G. L. Dunford	R1-51	X
			G. D. Forehand	R1-43	X
			K. A. Gasper	R1-15	X
			J. W. Hagan	R2-30	X
			M. N. Islam	R3-08	X
			L. A. Jensen	T5-01	X
			W. R. Klink	B3-30	X
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X	V. D. Maupin	5/15/89	V. D. Maupin	R1-51	X
			H. E. McGuire	R2-41	X
			J. A. Merrill	T6-18	X
			L. A. Morton	R3-08	X
X	K. J. Moss	5-15-89	K. J. Moss	R3-08	X
			K. W. Owens	R1-10	X
			L. L. Powers	R1-06	X
X	P. R. Praetorius	5-16-89	P. R. Praetorius	S1-51	X
X	R. E. Raymond	5-12-89	R. E. Raymond	R2-40	X
			A. R. Schade	R3-09	X
			D. E. Simpson	B3-51	X
			D. J. Washenfelder	R2-40	X
			R. K. Welty	R1-80	X
			R. D. Wojtasek	R1-10	X
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			DWM Central File	R2-28	X

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